

WHAT IS CLAIMED IS:

1. A denuder for collection and removal of a gaseous analyte from a sample gas, said denuder comprising:
 - a housing including an internal cavity;
 - a sample gas inlet fluidly coupled with a sample gas source;
 - a denuder liquid inlet fluidly coupled with a denuder liquid source; and
 - a barrier sheet extending across said internal cavity and separating said internal cavity into a liquid reservoir and a gas flow-through channel fluidly coupled with and downstream of said sample gas inlet, said barrier sheet having a liquid-reservoir surface and a gas-channel surface and being permeable to the liquid and to solution space species derived from the analyte gas of interest; and
 - a denuder liquid disposed in said liquid reservoir and permeating said barrier sheet to coat said gas-channel surface of said barrier sheet thereby allowing said denuder liquid on said gas-channel surface to contact the sample gas flowing within said gas flow-through channel and allowing the collected analyte to travel through said barrier sheet into said liquid reservoir.
2. The denuder of claim 1, wherein said housing is inert to the sample gas.
3. The denuder of claim 2, wherein at least a portion of said housing is formed of polytetrafluoroethylene, perfluoroalkoxy polytetrafluoroethylene or polycarbonate.
4. The denuder of claim 1, wherein said barrier sheet is a membrane.
5. The denuder of claim 4, wherein said membrane is hydrophilic.
6. The denuder of claim 5, wherein said membrane is formed of cellulose acetate, NAFION, polyvinyl acetate, cellulose nitrate or cellulose ester.

7. The denuder of claim 1, wherein said barrier sheet is substantially planar.
8. The denuder of claim 1, wherein said barrier sheet is substantially vertically oriented.
9. The denuder of claim 1, wherein said barrier sheet is not substantially vertically oriented.
10. The denuder of claim 1, wherein said housing comprises a side plate having an internal recess defining a portion of said internal cavity, said liquid reservoir is at least partially defined by said internal recess and said liquid-reservoir surface while said gas flow-through channel is at least partially defined by said gas-channel surface and a remainder of said internal cavity.
11. The denuder of claim 10, wherein said side plate comprises a textured surface within said internal recess.
12. The denuder of claim 10, wherein said side plate includes a denuder liquid inlet positioned at one end of said internal recess fluidly coupled to said denuder liquid reservoir and a denuder liquid outlet positioned at an opposing end of said internal recess.
13. The denuder of claim 12, wherein said denuder liquid outlet is fluidly coupled with a detector for said analyte.
14. The denuder of claim 12, wherein said internal recess includes rectangular shape having V-shaped ends.
15. The denuder of claim 14, wherein said denuder liquid inlet is positioned adjacent a lower one of said V-shaped ends and said denuder liquid outlet is positioned adjacent an upper end of said V-shaped ends.

16. The denuder of claim 1, wherein said liquid reservoir includes a denuder liquid outlet fluidly coupled with a chromatography system.

17. The denuder of claim 16 in which said chromatography system comprises an ion chromatography system, fluorescence detection system or an absorbance detection system.

18. The denuder of claim 1 in which said gas flow-through channel has an outlet fluidly coupled with a particle detector, a particle collector or a particle analysis system.

19. The denuder of claim 1, wherein said housing comprises:
a pair of parallel side plates, each side plate having an internal recess;
a spacer disposed between said side plates and having a central aperture aligned with said internal recesses, said side plates and said spacer forming said housing wherein said central aperture and said internal recesses define said internal cavity; and
a pair of barrier sheets separating said internal cavity into said gas flow-through channel and a pair of liquid reservoirs, each barrier sheet disposed between said spacer and a respective one of said parallel side plates.

20. A method for collection and removal of at least one gaseous analyte in a sample gas, said method comprising:

providing a denuder having a barrier sheet extending across and separating an internal cavity in a housing into a gas flow-through channel and a liquid reservoir;

providing a volume of denuder liquid in said liquid reservoir to permeate said barrier sheet and to coat a gas-channel surface of said barrier sheet with a film of said denuder liquid;

flowing a sample gas through said gas flow-through channel whereby the film of said denuder liquid on said gas-channel surface contacts said sample gas flowing

within said gas flow-through channel and the one analyte is collected and diffuses through said barrier sheet into said liquid reservoir; and

removing said volume of denuder liquid, including the diffused one analyte, from said gas flow-through channel for analysis.

21. The method of claim 19, wherein said one analyte comprises an atmospheric gas soluble directly or upon reaction, in the aqueous liquid.

22. The method of claim 19, wherein said method further comprises the step of orienting said denuder such that said barrier sheet is vertically oriented.

23. The method of claim 19, wherein said method further comprises the step of orienting said denuder such that said barrier sheet is non-vertically oriented.

24. The method of claim 19, in which said denuder includes a pair of parallel side plates, each having an internal recess partially defining a respective liquid reservoir, and a spacer having a central aperture aligned with said internal recesses and partially defining said gas flow-through channel, wherein said method further comprises:

disposing a barrier sheet between said spacer and each one of said parallel side plates to separate the internal cavity into said gas flow-through channel and a pair of liquid reservoirs; and

securing said spacer and said parallel side plates together.

25. The method of claim 24, wherein said method further comprises the step of trimming said barrier sheets along at least one of an outer periphery of said parallel side plates and an outer periphery of said spacer.

26. The method of claim 19 further comprising detecting the diffused analyte in said removed denuder liquid.

27. The method of claim 26 in which said sample gas comprises at least a second analyte and said method further comprises the step of separating said one and separate second analyte prior to detection.

28. The method of claim 27 in which said separation is performed by chromatography.

29. The method of claim 27 in which said method further comprises the step of fluorescence detection or absorbance detection.

30. The method of claim 19 in which said sample gas further comprises particles and said method further comprises analyzing the particles in said sample gas after exiting from said gas flow-through channel.